

WHAT IS CLAIMED IS:

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1. An image sensing apparatus for electronically
applying shake correction to sensed image data, and
outputting corrected image data, comprising:
shake detection means for detecting a shake;
sampling means capable of sampling shake information
detected by said shake detection means at a plurality of
sampling timings within one field period of said image
sensing apparatus;
selection means for selecting a shake information
signal at one of the plurality of sampling timings, which
corresponds to a drive condition of image sensing means at
the time of image sensing;
correction data calculation means for calculating a
shake correction data used in the shake correction by a
predetermined calculation of the shake information signal
selected by said selection means; and
correction means for applying the shake correction to
the sensed image data in accordance with the obtained shake
correction data.

2. The apparatus according to claim 1, wherein an
operation phase of said sampling means is variable within
a sampling interval.

3. The apparatus according to claim 1, wherein the sampling timing selected by said selection means corresponds to a substantially central time in a storage time period of the image sensing means.

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4. The apparatus according to claim 1, wherein said shake detection means comprises an angular velocity sensor for detecting shake angular displacements in two orthogonal directions.

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5. The apparatus according to claim 2, wherein said sampling means varies the sampling timing in accordance with the drive condition of the image sensing means.

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6. The apparatus according to claim 5, wherein said correction means sets an image data extraction position of a temporary storage memory in the image sensing device that stores an image signal in correspondence with the shake correction data calculated by said correction data calculation means, and outputs image data read out from the extraction position as shake-corrected sensed image data.

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7. The apparatus according to claim 1, wherein said sampling means comprises:

an A/D converter for A/D-converting an output from said shake detection means at the plurality of sampling timings within one field; and

an integral circuit for integrating a series of shake information signals detected at the plurality of sampling timings by said A/D converter in units of fields, and

said selection means selects an integrated signal, from a series of integrated signals output from said integral circuit, in correspondence with the drive condition of said image sensing apparatus.

8. The apparatus according to claim 1, wherein said sampling means comprises:

an A/D converter capable of A/D-converting an output from said shake detection means at an arbitrary sampling timing;

means for setting a timing corresponding to the drive condition of said image sensing apparatus in said A/D converter as a sampling timing; and

means for outputting an output signal from said A/D converter to said correction data calculation means.

9. The apparatus according to claim 1, wherein the drive condition includes a shutter speed.

10. A shake correction apparatus for correcting a shake contained in image data picked up by an external image sensing apparatus, comprising:

shake detection means for detecting a shake;

5 sampling means capable of sampling shake information detected by said shake detection means at a plurality of sampling timings within one field period of said image sensing apparatus;

10 selection means for selecting a shake information signal at one of the plurality of sampling timings, which corresponds to a drive condition of image sensing means at the time of image sensing;

15 correction data calculation means for calculating a shake correction data used in the shake correction by making a predetermined calculation of the shake information signal selected by said selection means; and

means for outputting the obtained shake correction data to the external image sensing apparatus.

20 11. The apparatus according to claim 10, wherein said sampling means samples the shake information a plurality of number of times within a predetermined period, said correction data calculation means calculates the shake correction data of the plurality of pieces of shake
25 information, and control means selects the shake correction data to be supplied to the image sensing apparatus from the

plurality of shake correction datas in accordance with the drive condition of the image sensing apparatus.

12. The apparatus according to claim 10, wherein said
5 sampling means varies the sampling timing in accordance with a change in storage time period of the image sensing apparatus.

13. The apparatus according to claim 12, wherein said
10 sampling means samples an output from said shake detection means at a timing corresponding to a substantially central time of the storage time period of the image sensing apparatus.

14. A shake correction apparatus for correcting a
15 shake contained in image data picked up by external image sensing means, comprising:

shake detection means for detecting a shake;

sampling means for sampling shake information detected
20 by said shake detection means at a predetermined timing;

correction data calculation means for converting the shake information sampled by said sampling means into a shake correction data by a calculation;

correction means for correcting a movement of an image
25 due to the shake at a predetermined cycle on the basis of

the calculation result of said correction data calculation means; and

control means for varying the sampling timing of the shake information by said sampling means in accordance with
5 a drive condition.

15. The apparatus according to claim 14, wherein said sampling means samples the shake information a plurality of number of times within a predetermined period, said
10 correction data calculation means calculates the shake correction datas of the plurality of pieces of shake information, and said control means selects the shake correction data to be supplied to said correction means from the plurality of shake correction datas in accordance with
15 the drive condition.

16. The apparatus according to claim 15, wherein said sampling means samples the shake information used for calculating the shake correction data to be supplied to said
20 correction means at a timing corresponding to a substantially central time of a storage time period of the image sensing means.

17. The apparatus according to claim 15, wherein said
25 correction means corrects the shake of the image by moving

an image extraction range in a direction to cancel the movement of the image due to the shake.

18. The apparatus according to claim 15, wherein an exposure condition is a shutter speed.

19. The apparatus according to claim 15, wherein the field period is a generation period of a video signal.

20. A shake correction method for electronically performing shake correction of sensed image data, comprising the steps of:

detecting a shake;

acquiring a shake information signal by sampling the detected shake information at a central timing of a storage time period set in correspondence with a drive condition at the time of image sensing of image sensing means;

calculating a shake correction data used in the shake correction by a predetermined calculation of the acquired shake information signal; and

applying the shake correction to the sensed image data in accordance with the obtained shake correction data.

21. A storage means for storing a control program for controlling an image sensing apparatus, storing a control program that implements a method of claim 20.

22. An image sensing apparatus comprising:
shake detection means for detecting a shake;
sampling means for sampling shake information detected
5 by said shake detection means at a predetermined timing;
correction data calculation means for converting the
shake information sampled by said sampling means into a shake
correction data by a calculation;
read control means for controlling a read timing of
10 an image sensing device on the basis of a calculation result
of said correction data calculation means; and
sampling timing control means for varying a sampling
timing of said sampling means in accordance with a drive
condition of the image sensing device.

23. The apparatus according to claim 22, wherein the
sampling point of the shake information is set at a
substantially central time in a storage time period of the
image sensing device.

24. An image sensing apparatus comprising:
shake detection means for detecting a shake;
sampling means for sampling shake information detected
by said shake detection means at a predetermined timing;

correction data calculation means for converting the shake information sampled by said sampling means into a shake correction data by a calculation;

5 read control means for controlling a read timing of an image sensing device on the basis of a calculation result of said correction data calculation means;

frequency detection means for detecting a frequency from the shake information obtained by said shake detection means; and

10 sampling timing control means for varying a sampling timing of said sampling means in correspondence with the frequency detected by said frequency detection means.

25. The apparatus according to claim 24, wherein said
15 sampling timing control means varies the sampling point of the shake information by a time period required for correcting frequency response characteristics of said shake detection means.

20 26. The apparatus according to claim 22, wherein said shake detection means comprises angular velocity detection means.

25 27. The apparatus according to claim 24, wherein said sampling timing control means corrects a frequency response

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delay of said shake correction means in accordance with an output from said frequency detection means.

28. A shake correction apparatus comprising:

- 5 shake detection means for detecting a shake;
 sampling means for sampling shake information detected by said shake detection means at a predetermined timing;
 correction data calculation means for converting the shake information sampled by said sampling means into a shake
10 correction data by a calculation;
 read control means for controlling a read timing of an image sensing device on the basis of a calculation result of said correction data calculation means;
 frequency detection means for detecting a frequency
15 from the shake information obtained by said shake detection means; and
 sampling timing control means for varying a sampling timing of said sampling means in accordance with the frequency obtained by said frequency detection means.

20 29. The apparatus according to claim 28, wherein the sampling point of the shake information is varied by a time period required for correcting frequency response characteristics of said shake detection means.

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30. The apparatus according to claim 29, wherein said shake detection means comprises angular velocity detection means.

5 31. A shake correction method comprising the steps of:
detecting a shake by shake detection means;
sampling shake information detected by said shake
detection means at a predetermined timing;

10 converting the sampled shake information into a shake
correction data by a calculation; and

controlling a read timing of an image sensing device
on the basis of the calculated shake correction data, and
varying a sampling timing in the sampling step in accordance
with a drive condition of the image sensing device.

15 32. The method according to claim 31, wherein the
sampling point of the shake information is set at a
substantially central time in a storage time period of the
image sensing device.

20 33. A shake correction method comprising the steps of:
detecting a shake by shake detection means;
sampling shake information detected by said shake
detection means at a predetermined timing;
25 converting the sampled shake information into a shake
correction data by a calculation;

detecting a shake frequency from the shake
information; and

controlling a read timing of an image sensing device
on the basis of the calculated shake correction data, and
5 varying a sampling timing in the sampling step in accordance
with the shake frequency.

34. A shake correction method comprising the steps of:
detecting a shake by shake detection means;
10 sampling the detected shake information at a
predetermined timing;

converting the sampled shake information into a shake
correction data by a calculation;

detecting a shake frequency from the shake
15 information; and

controlling a read timing of an image sensing device
on the basis of the calculated shake correction data, and
varying a sampling timing in the sampling step in accordance
with the shake frequency.

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35. The method according to claim 33, wherein the
sampling point of the shake information is varied by a time
period required for correcting frequency response
characteristics of said shake detection means.

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36. An image sensing method comprising:

the shake detection step of detecting a shake;
the sampling step of sampling shake information
detected in the shake detection step at a plurality of
predetermined even timings during one video period;

5 the shake correction data calculation step of
converting the shake information sampled in the sampling step
into a shake correction data by calculations at uneven
timings in correspondence with the number of times of
sampling; and

10 the shake correction step of correcting a shake of an
image sensing apparatus main body on the basis of a
calculation result in the shake correction data calculation
step.

15 37. The method according to claim 36, wherein the shake
correction data calculation step has the read control step
of controlling a read timing of an image sensing device
provided to the image sensing apparatus main body on the basis
of the calculation result by itself.

20 38. The method according to claim 36, wherein a sensor
used in the shake detection step is an angular velocity
sensor.

25 39. An image sensing apparatus comprising:
shake detection means for detecting a shake;

sampling means for sampling shake information detected by said shake detection means at a plurality of predetermined even timings during one video period;

shake correction data calculation means for converting
5 the shake information sampled by said sampling means into a shake correction data by calculations at uneven timings in correspondence with the number of times of sampling; and

shake correction means for correcting a shake of an image sensing apparatus main body on the basis of a
10 calculation result of said shake correction data calculation means.

40. The apparatus according to claim 39, wherein shake correction data calculation means has read control means for
15 controlling a read timing of an image sensing device provided to the image sensing apparatus main body on the basis of the calculation result by itself.

41. The apparatus according to claim 39, wherein said
20 shake detection means comprises an angular velocity sensor.

42. A storage medium that stores a control program for controlling an image sensing apparatus, said control program having control modules of the steps of:

25 detecting a shake of an image sensing apparatus main body;

sampling the detected shake information at a plurality of predetermined even timings during one video period;

converting the sampled shake information into a shake correction data by calculation at uneven timings in

5 correspondence with the number of times of sampling; and

correcting the shake of the image sensing apparatus main body on the basis of a calculation result of the shake correction data.

10 43. The medium according to claim 42, wherein said control program has a control module of the step of controlling a read timing of an image sensing device provided to the image sensing apparatus main body on the basis of the shake correction data calculation result.

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44. An image sensing method comprising:

the shake detection step of detecting a shake;

the sampling step of sampling shake information detected in the shake detection step at a plurality of

20 predetermined timings during one video period;

the correction data calculation step of converting the shake information into a shake correction data by a calculation on the basis of sampling operation in the sampling step;

the read control step of controlling a read timing of an image sensing device on the basis of a calculation result in the correction data calculation step;

the correction data determination step of selectively
5 determining the shake correction data calculated in the correction data calculation step at different timings depending on a drive condition of the image sensing device, and supplying the determined shake correction data to the read control step; and

10 the phase correction step of correcting a phase of a signal that pertains to the shake on the basis of the drive condition of the image sensing device.

45. An image sensing method comprising:

15 the shake detection step of detecting a shake;
the sampling step of sampling shake information detected in the shake detection step at a plurality of predetermined timings during one video period;

20 the correction data calculation step of converting the shake information into a shake correction data by a calculation on the basis of sampling operation in the sampling step;

the shake frequency detection step of detecting a shake frequency on the basis of the shake information detected in
25 the shake detection step;

the first phase correction step of correcting a phase of a signal that pertains to the shake on the basis of the shake frequency detected in the shake frequency detection step;

5 the read control step of controlling a read timing of an image sensing device on the basis of a calculation result in the correction data calculation step;

the correction data determination step of selectively determining the shake correction data calculated in the
10 correction data calculation step at different timings depending on a drive condition of the image sensing device, and supplying the determined shake correction data to the read control step; and

the second phase correction step of correcting the
15 phase of the signal that pertains to the shake on the basis of the drive condition of the image sensing device and the shake frequency detected in the shake frequency detection step.

20 46. An image sensing method comprising:

the shake detection step of detecting a shake;

the sampling step of sampling shake information detected in the shake detection step at a plurality of predetermined timings during one video period;

25 the correction data calculation step of converting the shake information into a shake correction data by a

calculation on the basis of sampling operation in the
sampling step;

the read control step of controlling a read timing of
an image sensing device on the basis of a calculation result
5 in the correction data calculation step;

the correction data determination step of selectively
determining the shake correction data calculated in the
correction data calculation step at different timings
depending on a drive condition of the image sensing device,
10 and supplying the determined shake correction data to the
read control step;

the shake frequency detection step of detecting a shake
frequency on the basis of the shake information detected in
the shake detection step; and

15 the phase correction step of correcting a phase of a
signal that pertains to the shake on the basis of a drive
condition of the image sensing device and the shake frequency
detected in the shake frequency detection step.

20 47. The method according to claim 44, wherein the drive
condition of the image sensing device is a condition for
defining drive operation for varying an actual storage time
period of the image sensing device.

25 48. The method according to claim 45, wherein the drive
condition of the image sensing device is a condition for

defining drive operation for varying an actual storage time
period of the image sensing device.

49. The method according to claim 46, wherein the drive
5 condition of the image sensing device is a condition for
defining drive operation for varying an actual storage time
period of the image sensing device.

50. The method according to claim 44, wherein the
10 signal that pertains to the shake is a shake signal.

51. The method according to claim 45, wherein the
signal that pertains to the shake is a shake signal.

52. The method according to claim 46, wherein the
15 signal that pertains to the shake is a shake signal.

53. The method according to claim 44, wherein the
signal that pertains to the shake is a shake correction
20 signal.

54. The method according to claim 45, wherein the
signal that pertains to the shake is a shake correction
signal.
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55. The method according to claim 46, wherein the signal that pertains to the shake is a shake correction signal.

5 56. The method according to claim 44, wherein the drive condition of the image sensing device is a selection timing in the correction data determination step.

10 57. The method according to claim 45, wherein the drive condition of the image sensing device is a selection timing in the correction data determination step.

15 58. The method according to claim 46, wherein the drive condition of the image sensing device is a selection timing in the correction data determination step.

59. An image sensing apparatus comprising:
shake detection means for detecting a shake;
sampling means for sampling shake information detected
20 by said shake detection means at a plurality of predetermined timings during one video period;
correction data calculation means for converting the shake information into a shake correction data by a calculation on the basis of sampling operation of said
25 sampling means;

read control means for controlling a read timing of an image sensing device on the basis of a calculation result of said correction data calculation means;

correction data determination means for selectively
5 determining the shake correction data calculated by said correction data calculation means at different timings depending on a drive condition of the image sensing device, and supplying the determined shake correction data to said read control means; and

10 phase correction means for correcting a phase of a signal that pertains to the shake on the basis of the drive condition of the image sensing device.

60. An image sensing apparatus comprising:

15 shake detection means for detecting a shake;
sampling means for sampling shake information detected by said shake detection means at a plurality of predetermined timings during one video period;

correction data calculation means for converting the
20 shake information into a shake correction data by a calculation on the basis of sampling operation of said sampling means;

shake frequency detection means for detecting a shake frequency on the basis of the shake information detected by
25 said shake detection means;

first phase correction means for correcting a phase of a signal that pertains to the shake on the basis of the shake frequency detected by said shake frequency detection means;

5 read control means for controlling a read timing of an image sensing device on the basis of a calculation result of said correction data calculation means;

correction data determination means for selectively determining the shake correction data calculated by said
10 correction data calculation means at different timings depending on a drive condition of the image sensing device, and supplying the determined shake correction data to said read control means; and

second phase correction means for correcting the phase
15 of the signal that pertains to the shake on the basis of the drive condition of the image sensing device and the shake frequency detected by said shake frequency detection means.

61. An image sensing apparatus comprising:

20 shake detection means for detecting a shake;

sampling means for sampling shake information detected by said shake detection means at a plurality of predetermined timings during one video period;

correction data calculation means for converting the
25 shake information into a shake correction data by a

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calculation on the basis of sampling operation of said
sampling means;

read control means for controlling a read timing of
an image sensing device on the basis of a calculation result
5 of said correction data calculation means;

correction data determination means for selectively
determining the shake correction data calculated by said
correction data calculation means at different timings
depending on a drive condition of the image sensing device,
10 and supplying the determined shake correction data to said
read control means;

shake frequency detection means for detecting a shake
frequency on the basis of the shake information detected by
said shake detection means; and

15 phase correction means for correcting a phase of a
signal that pertains to the shake on the basis of a drive
condition of the image sensing device and the shake frequency
detected by said shake frequency detection means.

20 62. The apparatus according to claim 59, wherein the
drive condition of the image sensing device is a condition
for defining drive operation for varying an actual storage
time period of the image sensing device.

25 63. The apparatus according to claim 60, wherein the
drive condition of the image sensing device is a condition

for defining drive operation for varying an actual storage
time period of the image sensing device.

64. The apparatus according to claim 61, wherein the
5 drive condition of the image sensing device is a condition
for defining drive operation for varying an actual storage
time period of the image sensing device.

65. The apparatus according to claim 59, wherein the
10 signal that pertains to the shake is a shake signal.

66. The apparatus according to claim 60, wherein the
signal that pertains to the shake is a shake signal.

67. The apparatus according to claim 61, wherein the
15 signal that pertains to the shake is a shake signal.

68. The apparatus according to claim 59, wherein the
signal that pertains to the shake is a shake correction
20 signal.

69. The apparatus according to claim 60, wherein the
signal that pertains to the shake is a shake correction
signal.

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70. The apparatus according to claim 61, wherein the signal that pertains to the shake is a shake correction signal.

5 71. The apparatus according to claim 59, wherein said image sensing apparatus is a video camera.

72. The apparatus according to claim 60, wherein said image sensing apparatus is a video camera.

10 73. The apparatus according to claim 61, wherein said image sensing apparatus is a video camera.

74. The apparatus according to claim 59, wherein the drive condition of the image sensing device is a selection timing of said correction data determination means.

15 75. A storage medium storing a control program that implements an image sensing method of claim 44 to control an image sensing apparatus.

20 76. A storage medium storing a control program that implements an image sensing method of claim 45 to control an image sensing apparatus.

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77. A storage medium storing a control program that implements an image sensing method of claim 46 to control an image sensing apparatus.

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